NAME

****SUBJECT KNOWLEDGE AUDIT SECONDARY XXXXXXX

Throughout the training year you are required to take personal responsibility for renewing and updating your subject knowledge, identifying areas for development, setting personal targets and addressing any areas of weakness. This process commences now, before the course starts, and will continue throughout.

RAG Rate your confidence in each area with a grade. **RED (High) Green (Low)** Highlight the statements which you believe require development

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|  | **Teachers should understand:** | Pre-Interview | Pre- programme | Assessment Point 1 | Assessment Point 2 | Assessment Point 3 | Assessment Point 4 |
|  | P1.1 THE PARTICLE MODEL |  |  |  |  |  |  |
| 1.1a | Describe how and why the atomic model has changed over time. |  |  |  |  |  |  |
| 1.1b | Describe the atom as a positively charged nucleus surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with almost all of the mass in the nucleus. |  |  |  |  |  |  |
| 1.1c | Recall the typical size (order of magnitude) of atoms and small molecules. |  |  |  |  |  |  |
| 1.1d | define density. |  |  |  |  |  |  |
| 1.1e | Explain the differences in density between the different states of matter in terms of the arrangements of the atoms and molecules. |  |  |  |  |  |  |
| 1.1f | Apply the relationship between density, mass and volume to changes where mass is conserved. |  |  |  |  |  |  |
|  | P1.2 CHANGES OF STATE |  |  |  |  |  |  |
| 1.2a | Describe how mass is conserved when substances melt, freeze, evaporate, condense or sublimate. |  |  |  |  |  |  |
| 1.2b | Describe that these physical changes differ from chemical changes because the material recovers its original properties if the change is reversed. |  |  |  |  |  |  |
| 1.2c | Describe how heating a system will change the energy stored within the system and raise its temperature or produce changes of state. |  |  |  |  |  |  |
| 1.2d | Define the term specific heat capacity and distinguish between it and the term specific latent heat. |  |  |  |  |  |  |
| 1.2e | Apply the relationship between change in internal energy of a material and its mass, specific heat capacity and temperature change to calculate the energy change involved. |  |  |  |  |  |  |
| 1.2f | Apply the relationship between specific latent heat and mass to calculate the energy change involved in a change of state. |  |  |  |  |  |  |
| 1.2g | Explain how the motion of the molecules in a gas is related both to its temperature and its pressure. |  |  |  |  |  |  |
| 1.2h | Explain the relationship between the temperature of a gas and its pressure at constant volume (qualitative only). |  |  |  |  |  |  |
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|  | P2.1 MOTION |  |  |  |  |  |  |
| 2.1a | Describe how to measure distance and time in a range of scenarios. |  |  |  |  |  |  |
| 2.1b | Describe how to measure distance and time and use these to calculate speed. |  |  |  |  |  |  |
| 2.1c | Make calculations using ratios and proportional reasoning to convert units and to compute rates. |  |  |  |  |  |  |
| 2.1d | Explain the vector-scalar distinction as it applies to displacement and distance, velocity and speed. |  |  |  |  |  |  |
| 2.1e | Relate changes and differences in motion to appropriate distance-time, and velocity-time graphs; interpret lines and slopes. |  |  |  |  |  |  |
| **2.1f** | **Interpret enclosed areas in velocity-time graphs.** |  |  |  |  |  |  |
| 2.1g | Calculate average speed for non-uniform motion. |  |  |  |  |  |  |
| 2.1h | Apply formulae relating distance, time and speed, for uniform motion, and for motion with uniform acceleration. |  |  |  |  |  |  |
|  | P2.2 NEWTON’S LAWS |  |  |  |  |  |  |
| 2.2a | Recall examples of ways in which objects interact. |  |  |  |  |  |  |
| 2.2b | Describe how such examples involve interactions between pairs of objects which produce a force on each object. |  |  |  |  |  |  |
| 2.2c | Represent such forces as vectors. |  |  |  |  |  |  |
| 2.2d | Apply Newton’s First Law to explain the motion of an object moving with uniform velocity and also an object where the speed and/or direction change. |  |  |  |  |  |  |
| **2.2e** | **Use vector diagrams to illustrate resolution of forces, a net force (resultant force), and equilibrium situations.** |  |  |  |  |  |  |
| **2.2f** | **Describe examples of the forces acting on an isolated solid object or system.** |  |  |  |  |  |  |
| **2.2g** | **Describe, using free body diagrams, examples where two or more forces lead to a resultant force on an object.** |  |  |  |  |  |  |
| **2.2h** | **Describe using free body force diagrams the special case of balanced forces when the resultant force is zero (qualitative only).** |  |  |  |  |  |  |
| 2.2i | Apply Newton’s Second Law in calculations relating forces, masses and accelerations. |  |  |  |  |  |  |
| **2.2j** | **Explain that inertia is a measure of how difficult it is to change the velocity of an object and that the mass is defined as the ratio of force over acceleration.** |  |  |  |  |  |  |
| **2.2k** | **Define momentum and describe examples of momentum in collisions.** |  |  |  |  |  |  |
| 2.2l | Use the relationship between work done, force, and distance moved along the line of action of the force and describe the energy transfer involved. |  |  |  |  |  |  |
| 2.2m | Calculate relevant values of stored energy and energy transfers; convert between newton-metres and joules. |  |  |  |  |  |  |
| 2.2n | Explain, with reference to examples, the definition of power as the rate at which energy is transferred. |  |  |  |  |  |  |
| 2.2o | Recall and apply Newton’s Third Law. |  |  |  |  |  |  |
| **2.2p** | **Explain why an object moving in a circle with a constant speed has a changing velocity (qualitative only).** |  |  |  |  |  |  |
|  | P2.3 FORCES IN ACTION |  |  |  |  |  |  |
| 2.3a | Explain, that to stretch, bend or compress an object, more than one force has to be applied. |  |  |  |  |  |  |
| 2.3b | Describe the difference between elastic and plastic deformation (distortions) caused by stretching forces. |  |  |  |  |  |  |
| 2.3c | Describe the relationship between force and extension for a spring and other simple systems. |  |  |  |  |  |  |
| 2.3d | Describe the difference between linear and non-linear relationships between force and extension. |  |  |  |  |  |  |
| 2.3e | Calculate a spring constant in linear cases. |  |  |  |  |  |  |
| 2.3f | Calculate the work done in stretching. |  |  |  |  |  |  |
| 2.3g | Describe that all matter has a gravitational field that causes attraction, and the field strength is much greater for massive objects. |  |  |  |  |  |  |
| 2.3h | Define weight, describe how it is measured and describe the relationship between the weight of an object and the gravitational field strength (g). |  |  |  |  |  |  |
| 2.3i | Recall the acceleration in free fall. |  |  |  |  |  |  |
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|  | P3.1 STATIC & CHARGE |  |  |  |  |  |  |
| 3.1a | Describe that charge is a property of all matter and that there are positive and negative charges. |  |  |  |  |  |  |
| 3.1b | Describe the production of static electricity, and sparking, by rubbing surfaces, and evidence that charged objects exert forces of attraction or repulsion on one another when not in contact. |  |  |  |  |  |  |
| 3.1c | Explain how transfer of electrons between objects can explain the phenomena of static electricity. |  |  |  |  |  |  |
| 3.1d | Recall that current is a rate of flow of charge (electrons) and the conditions needed for charge to flow. |  |  |  |  |  |  |
| 3.1e | Recall that current has the same value at any point in a single closed loop. |  |  |  |  |  |  |
| 3.1f | Recall and use the relationship between quantity of charge, current and time. |  |  |  |  |  |  |
|  | P3.2 SIMPLE CIRCUITS |  |  |  |  |  |  |
| 3.2a | Describe the differences between series and parallel circuits. |  |  |  |  |  |  |
| 3.2b | Represent d.c. circuits with the conventions of positive and negative terminals, and the symbols that represent common circuit elements. |  |  |  |  |  |  |
| 3.2c | Recall that current (I) depends on both resistance (R) and potential difference (V) and the units in which these are measured. |  |  |  |  |  |  |
| 3.2d | Recall and apply the relationship between I, R and V and that for some resistors the value of R remains constant but that in others it can change as the current changes. |  |  |  |  |  |  |
| 3.2e | Explain that for some resistors the value of R remains constant but that in others it can change as the current changes. |  |  |  |  |  |  |
| 3.2f | Explain the design and use of circuits to explore such effects. |  |  |  |  |  |  |
| 3.2g | Use graphs to explore whether circuit elements are linear or non-linear. |  |  |  |  |  |  |
| 3.2h | Use graphs and relate the curves produced to the function and properties of circuit elements. |  |  |  |  |  |  |
| 3.2i | Explain, why, if two resistors are in series the net resistance is increased, whereas with two in parallel the net resistance is decreased (qualitative explanation only). |  |  |  |  |  |  |
| 3.2j | Calculate the currents, potential differences and resistances in d.c. series and parallel circuits. |  |  |  |  |  |  |
| 3.2k | Explain the design and use of such circuits for measurement and testing purposes. |  |  |  |  |  |  |
| 3.2l | Explain how the power transfer in any circuit device is related to the potential difference across it and the current, and to the energy changes over a given time. |  |  |  |  |  |  |
| 3.2m | Apply the equations relating potential difference, current, quantity of charge, resistance, power, energy, and time, and solve problems for circuits which include resistors in series, using the concept of equivalent resistance. |  |  |  |  |  |  |
|  | P3.3 MAGNETS & MAGNETIC FIELDS |  |  |  |  |  |  |
| 3.3a | Describe the attraction and repulsion between unlike and like poles for permanent magnets. |  |  |  |  |  |  |
| 3.3b | Describe the difference between permanent and induced magnets. |  |  |  |  |  |  |
| 3.3c | Describe the characteristics of the magnetic field of a magnet, showing how strength and direction, change from one point to another. |  |  |  |  |  |  |
| 3.3d | Explain how the behaviour of a magnetic (dipping) compass is related to evidence that the core of the Earth must be magnetic. |  |  |  |  |  |  |
| 3.3e | Describe how to show that a current can create a magnetic effect and describe the directions of the magnetic field around a conducting wire. |  |  |  |  |  |  |
| 3.3f | Recall that the strength of the field depends on the current and the distance from the conductor. |  |  |  |  |  |  |
| 3.3g | Explain how solenoid arrangements can enhance the magnetic effect. |  |  |  |  |  |  |
| **3.3h** | **Describe how a magnet and a current-carrying conductor exert a force on one another.** |  |  |  |  |  |  |
| **3.3i** | **Show that Fleming’s left-hand rule represents the relative orientations of the force, the current and the magnetic field.** |  |  |  |  |  |  |
| **3.3j** | **Apply the equation that links the force on a conductor to the magnetic flux density, the current and the length of conductor to calculate the forces involved.** |  |  |  |  |  |  |
| **3.3k** | **Explain how the force exerted from a magnet and a current-carrying conductor is used to cause rotation in electric motors.** |  |  |  |  |  |  |
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|  | P4.1 WAVE BEHAVIOUR |  |  |  |  |  |  |
| 4.1a | Describe wave motion in terms of amplitude, wavelength, frequency and period. |  |  |  |  |  |  |
| 4.1b | Define wavelength and frequency. |  |  |  |  |  |  |
| 4.1c | Describe and apply the relationship between wavelength, frequency and the wave velocity. |  |  |  |  |  |  |
| 4.1d | Apply formulae relating velocity, frequency and wavelength. |  |  |  |  |  |  |
| 4.1e | Describe differences between transverse and longitudinal waves. |  |  |  |  |  |  |
| 4.1f | Describe how ripples on water surfaces are used to model transverse waves whilst sound waves in air are longitudinal waves, and how the speed of each may be measured. |  |  |  |  |  |  |
| 4.1g | Describe evidence that in both cases it is the wave and not the water or air itself that travels. |  |  |  |  |  |  |
|  | P4.2 THE ELECTROMAGNETIC SPECTRUM |  |  |  |  |  |  |
| 4.2a | Recall that electromagnetic waves are transverse and are transmitted through space where they all have the same velocity. |  |  |  |  |  |  |
| 4.2b | Explain that electromagnetic waves transfer energy from source to absorber. |  |  |  |  |  |  |
| 4.2c | Apply the relationships between frequency and wavelength across the electromagnetic spectrum. |  |  |  |  |  |  |
| 4.2d | Describe the main groupings of the electromagnetic spectrum and that these groupings range from long to short wavelengths and from low to high frequencies. |  |  |  |  |  |  |
| 4.2e | Describe that our eyes can only detect a limited range of the electromagnetic spectrum. |  |  |  |  |  |  |
| 4.2f | Recall that light is an electromagnetic wave. |  |  |  |  |  |  |
| 4.2g | Give examples of some practical uses of electromagnetic waves in the radio, microwave, infra-red, visible, ultra-violet, X-ray and gamma-ray regions. |  |  |  |  |  |  |
| 4.2h | Describe how ultra-violet waves, X-rays and gamma rays can have hazardous effects, notably on human bodily tissues. |  |  |  |  |  |  |
| **4.2i** | **Recall that radio waves can be produced by, or can themselves induce, oscillations in electrical circuits.** |  |  |  |  |  |  |
| **4.2j** | **Recall that different substances may absorb, transmit, refract, or reflect electromagnetic waves in ways that vary with wavelength.** |  |  |  |  |  |  |
| **4.2k** | **Explain how some effects are related to differences in the velocity of electromagnetic waves in different substances.** |  |  |  |  |  |  |
|  | P4.3 RADIOACTIVITY |  |  |  |  |  |  |
| 4.3a | Recall that atomic nuclei are composed of both protons and neutrons, that the nucleus of each element has a characteristic positive charge. |  |  |  |  |  |  |
| 4.3b | Recall that atoms of the same elements can differ in nuclear mass by having different numbers of neutrons. |  |  |  |  |  |  |
| 4.3c | Use the conventional representation for nuclei to relate the differences between isotopes. |  |  |  |  |  |  |
| 4.3d | Recall that some nuclei are unstable and may emit alpha particles, beta particles, or neutrons, and electromagnetic radiation as gamma rays. |  |  |  |  |  |  |
| 4.3e | Relate these emissions to possible changes in the mass or the charge of the nucleus, or both. |  |  |  |  |  |  |
| 4.3f | Use names and symbols of common nuclei and particles to write balanced equations that represent radioactive decay. |  |  |  |  |  |  |
| 4.3g | Balance equations representing the emission of alpha, beta or gamma radiations in terms of the masses, and charges of the atoms involved. |  |  |  |  |  |  |
| 4.3h | Recall that in each atom its electrons are arranged at different distances from the nucleus, that such arrangements may change with absorption or emission of electromagnetic radiation and that atoms can become ions by loss of outer electrons. |  |  |  |  |  |  |
| 4.3i | Recall that changes in atoms and nuclei can also generate and absorb radiations over a wide frequency range. |  |  |  |  |  |  |
| 4.3j | Explain the concept of half-life and how this is related to the random nature of radioactive decay. |  |  |  |  |  |  |
| **4.3k** | **Calculate the net decline, expressed as a ratio, during radioactive emission after a given (integral) number of half-lives.** |  |  |  |  |  |  |
| 4.3l | Recall the differences in the penetration properties of alpha-particles, beta-particles and gamma-rays. |  |  |  |  |  |  |
| 4.3m | Recall the differences between contamination and irradiation effects and compare the hazards associated with these two. |  |  |  |  |  |  |
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|  | P5.1 WORK DONE |  |  |  |  |  |  |
| 5.1a | Describe for situations where there are energy transfers in a system, that there is no net change to the total energy of a closed system (qualitative only). |  |  |  |  |  |  |
| 5.1b | Describe all the changes involved in the way energy is stored when a system changes for common situations. |  |  |  |  |  |  |
| 5.1c | Describe the changes in energy involved when a system is changed by heating (in terms of temperature change and specific heat capacity), by work done by forces, and by work done when a current flows. |  |  |  |  |  |  |
| 5.1d | Make calculations of the energy changes associated with changes in a system, recalling or selecting the relevant equations for mechanical, electrical, and thermal processes; thereby express in quantitative form and on a common scale the overall redistribution of energy in the system. |  |  |  |  |  |  |
| 5.1e | Calculate the amounts of energy associated with a moving body, a stretched spring and an object raised above ground level. |  |  |  |  |  |  |
|  | P5.2 POWER & EFFICIENCY |  |  |  |  |  |  |
| 5.2a | Describe, with examples, the process by which energy is dissipated, so that it is stored in less useful ways. |  |  |  |  |  |  |
| 5.2b | Describe how, in different domestic devices, energy is transferred from batteries or the a.c. from the mains. |  |  |  |  |  |  |
| 5.2c | Describe, with examples, the relationship between the power ratings for domestic electrical appliances and how this is linked to the changes in stored energy when they are in use. |  |  |  |  |  |  |
| 5.2d | Calculate energy efficiency for any energy transfer. |  |  |  |  |  |  |
| **5.2e** | **Describe ways to increase efficiency.** |  |  |  |  |  |  |
| 5.2f | Explain ways of reducing unwanted energy transfer. |  |  |  |  |  |  |
| 5.2g | Describe how the rate of cooling is effected by the thickness and thermal conductivity of its walls (qualitative only). |  |  |  |  |  |  |
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|  | P6.1 PHYSICS ON THE MOVE |  |  |  |  |  |  |
| 6.1a | Recall typical speeds encountered in everyday experience for wind and sound, and for walking, running, cycling and other transportation systems. |  |  |  |  |  |  |
| 6.1b | Estimate the magnitudes of everyday accelerations. |  |  |  |  |  |  |
| 6.1c | Make calculations using ratios and proportional reasoning to convert units and to compute rates. |  |  |  |  |  |  |
| 6.1d | Explain methods of measuring human reaction times and recall typical results. |  |  |  |  |  |  |
| 6.1e | Explain the factors which affect the distance required for road transport vehicles to come to rest in emergencies and the implications for safety. |  |  |  |  |  |  |
| 6.1f | Explain the dangers caused by large decelerations. |  |  |  |  |  |  |
|  | P6.2 POWERING THE EARTH |  |  |  |  |  |  |
| 6.2a | Describe the main energy sources available for use on Earth, compare the ways in which they are used and distinguish between renewable and non-renewable sources. |  |  |  |  |  |  |
| 6.2b | Explain patterns and trends in the use of energy resources. |  |  |  |  |  |  |
| 6.2c | Recall that, in the national grid, electrical power is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic use. |  |  |  |  |  |  |
| 6.2d | Recall that step-up and step-down transformers are used to change the potential difference as power is transferred from power stations. |  |  |  |  |  |  |
| 6.2e | Explain how the national grid is an efficient way to transfer energy. |  |  |  |  |  |  |
| 6.2f | Recall that the domestic supply in the UK is a.c.at 50 Hz and about 230 volts. |  |  |  |  |  |  |
| 6.2g | Explain the difference between direct and alternating voltage. |  |  |  |  |  |  |
| 6.2h | Recall the differences in function between the live, neutral and earth mains wires, and the potential differences between these wires. |  |  |  |  |  |  |
| 6.2i | Explain that a live wire may be dangerous even when a switch in a mains circuit is open, and explain the dangers of providing any connection between the live wire and earth. |  |  |  |  |  |  |